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Serial #_____

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All information contained herein is believed to be accurate and correct. However, no responsibility for errors, omissions or any problem arising by the use of this material is assumed by Velonex.

WARNING

The Model V-3300 Fast Transient/Burst Generator contains voltages which could be dangerous if contacted. All reasonable safety precautions have been taken in the design and manufacture of this instrument. DO NOT attempt to defeat the protection provided. Power should be removed and high voltage capacitors should be discharged prior to any maintenance work. Only recommended replacement parts should be used. The Model V-3300 should be operated and maintained only by personnel qualified to work with high voltage equipment.

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Prior to Installation

1 Claim For Damage in Shipment This instrument should be tested as soon as possible after receipt. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent and this report should be forwarded to Velonex. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number and serial number when referring to this instrument for any reason.

2 Warranty Velonex warrants each instrument manufactured by us to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof. This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and when upon our examination, it is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions or operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty and include the model number and serial number. On receipt of this information, we will give you service data or shipping instructions.

2. On receipt of shipping instructions, forward the instrument prepaid to the factory. If requested, instrument is not covered by the warranty.

3 Shipping All shipments of Velonex instruments should be made via Air or alternately via Truck if shipping distance is under 300 miles. The instrument(s) should be either repacked in the original shipping container or packed in a strong exterior container and surrounded by at least three inches of excelsior or similar shock absorbing material.

4 Proprietary Notice Information contained in this manual is the property of Velonex. It is issued with the understanding that none of this material may be reproduced or copied without written permission from Velonex.

General Description

1 Introduction The Model V-3300 Fast Transient/Burst Generator is used to test the susceptibility of electronic equipment to electrical noise as specified by IEC 801-4. The model V-3300 produces the specified waveform to be used in conjunction with the capacitive coupling clamp model V-3334 or the internal isolation network. The V-3334 capacitive coupling clamp allow injection of fast transients burst into wire bundles. In addition, the Model V-3300 has a built-in coupler/isolation network, where the output of the Model V-3300 can be fed into the EUT power input while isolating the transients from feeding downstream into the mains.

2 Model V-3300 Specifications:

Pulse Amplitude (Eo):	0.5-4.4kV (Open Circuit) 0.25-2.2kV (into 50Ω)
Rise Time (Tr):	5ns + 30% (10-90% open circuit and into 50Ω)
Pulse Width (Tw):	50ns + 30% (at 50% open circuit and into 50Ω)
Source Impedance (Zo):	50Ω + 20% Effective
Pulse Repetition Frequency:	10kHz Maximum
Burst Duration:	0.1-20ms
Burst Period:	90-330ms

Features

Output Polarity:	Front Panel Selectable
Shielding:	Surge Signals are shielded to prevent unwanted radiations or conductance of signals.
Scope Trigger Output:	A ground isolated front panel oscilloscope trigger provides synchronization with the pulse event.
Metering:	A front panel digital panel voltmeter indicates approximate peak voltage output voltage into an open circuit.
Ready Indicator:	A front panel green indicator light advises the operator when the unit is ready for test.
GPIB Programmability:	The Model V-3300 can be programmed via the GPIB Bus through an external connector on the rear of the Model V-3300.
High-Voltage Protection:	A push on/push off high voltage switch is utilized to switch on and off high voltage. A front panel interlock can be utilized for safety high voltage turn off for test fixtures.

Power Requirements:	Line input is 115V/230V +/-10%, 50/60Hz, 200 watts. Output is regulated to minimize the effects of input line variations. For other power requirements, order the following options. 100V +10%, 60Hz for Model V-3300-J 100V +10%, 50Hz for Model V-3300-Q 200V +10%, 50Hz for Model V-3300-W
Mechanical:	Housed in a cabinet 19-3/4" wide, 8 1/4" high, and 21-1/2" depth. Standard 19" rack-mounting is also available, specify Model V-3300-R
Weight:	Approximately 90 lbs. (cabinet model)

3 Available Accessories

The Model V-3334, Capacitive Coupling Clamp, allows the fast transients/Burst to be injected into wire bundles as specified by IEC 801-4.

4 Available Options:

Option Designator	Description
D	DC Injection Capability
R	Rack Mounting
G	30A Isolation Network

Front Panel

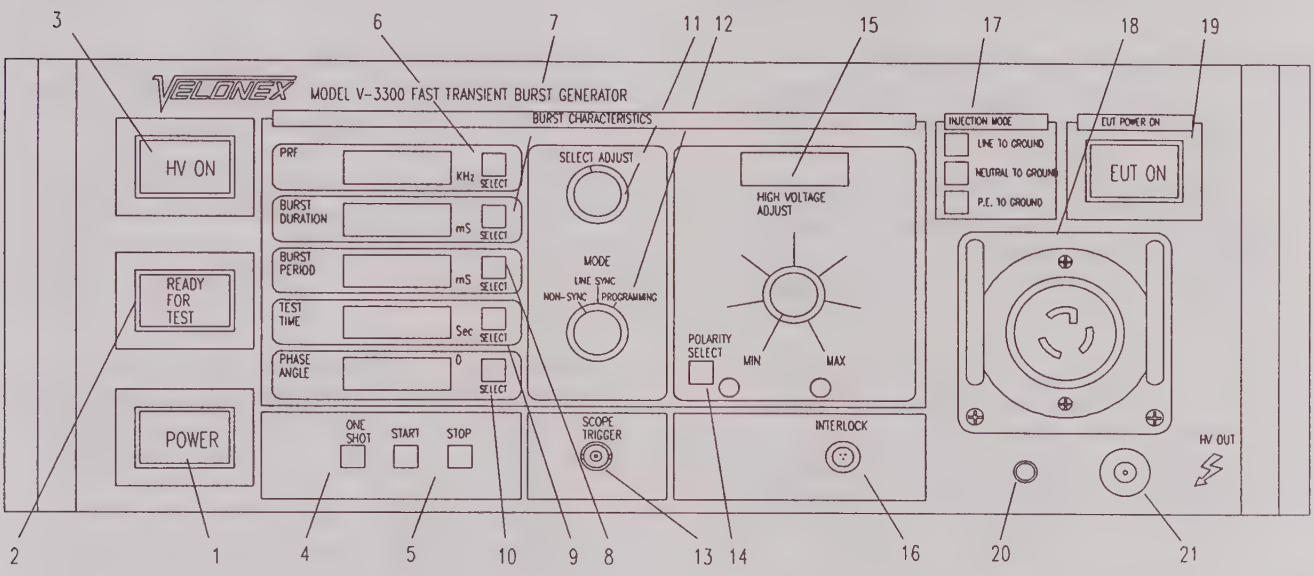


Figure 1 V-3300 Front Panel

The following is a brief description of the V-3300 front panel controls. Please refer to Figure 1 for a visual location.

1 Power Push Button The Power Push Button is the main power switch which controls all power to the unit. As soon as the power switch is pushed, a four minute warm-up is required by the Model V-3300. A four minute counter is visible on the "Test Time" Display. During this four minute warm-up time, none of the buttons on the Model V-3300 are operable until the warm up time has expired. After four minutes, the Model V-3300 is ready for testing.

2 Ready for Test Indicator The Ready for Test Indicator is located on the front panel and is illuminated after a four minute warm up period. This light will remain illuminated until the Model V-3300 is turned off.

Note: Each time the Model V-3300 is turned-on, the ready-for-test light will take four minutes to be illuminated.

3 HV-ON Push Button The high voltage output will be turned on when the HV-ON Button has been pushed. Pressing the high voltage button while high voltage is on will turn the high voltage off.

4 One-Shot Push Button The One-Shot push button will produce a single pulse when pressed.

5 Start/Stop Push Buttons When the Green button is pushed, burst packets with the displayed characteristics will appear at the output, as long as the red stop button is not pushed.

6 PRF Push Button When this button has been pressed, the frequency of the pulse can be adjusted by the adjust knob located on the front panel. The frequency can be adjusted in steps of 10Hz from 100Hz to 5.5kHz.

7 Burst Duration Push Button When this button has been pressed, the Burst duration of the pulse can be

adjusted with the adjust knob from 0.1 to 20ms in steps of 0.1ms.

8 Burst Period Push Button When this button has been pressed, the burst period can be adjusted with the adjust knob from 90 ms to 330ms in steps of 1ms.

9 Test Time Push Button When this button has been pressed, the test time can be adjusted with the adjust knob from 1s to 99s in steps of 0.1s.

Note: For Free Running Mode, increase the test time to more than 99s, such that no digits are visible on the test time display. Press the start button for continuous testing, then press the red stop button to stop testing at any time desired.

10 Phase Angle Push Button When in the line-sync mode and this button has been pressed, the phase angle can be adjusted with the adjust knob from the 0 to 360o in steps of 1o.

11 Select Adjust Knob This knob allows the operator to increase or decrease any variable discussed in paragraphs 6 through 10. When this knob is turned clockwise the variable will increase, and when this knob is turned counterclockwise the variable will decrease accordingly.

12 Mode Select Switch

Position 1: Non-Sync Selects an asynchronous trigger that runs at the settings of the front panel displays. Note that the phase angle display will not come on.

Position 2: Line Sync Selects an AC power line synchronized trigger that runs at the settings of the front panel phase angle display. The Line Sync trigger is phase synced from 0 to 360o. The AC Power line is the source for the E.U.T.

Position 3: Programming Selects the unit for programming via the GPIB connector in the rear of the Model V-3300-S. While in this mode the unit can be addressed and controlled by a GPIB controller. The front panel controls in this mode are disabled with the exception of the high voltage off button, the interlock and the power off button.

13 Scope Trigger Output A Scope Trigger is obtained by attaching a BNC Connector to the front panel. This provides a trigger pulse for oscilloscope synchronizing purposes. The Trigger is of positive polarity and approximately 5 volts. A Scope Trigger is present whenever start is on.

14 Polarity Push Button Pulse Polarity is selected via the push button located on the front panel. Two LED's are incorporated to indicate a positive or negative output.

15 Panel Meter The DPM (Digital Panel Meter) indicates the approximate peak voltage when the High voltage light is on. The meter is provided for reference purposes, and should not be used for accurate pulse measurements.

16 High-Voltage Interlock In order for high voltage to be turned on, pins 1 and 2 of connector J104 on the front panel (Figure-1 #16) must be shorted together. This can easily be accomplished with plug P104 provided with the unit or an interlock cable when using the V-3300 in conjunction with the V-3334.

17 Injection Mode Push Buttons The filter allows for three common mode tests, (See Figure 1 #17). By pressing the appropriate push button three different common modes of injection can be activated; line to ground, neutral to ground and P.E. to ground.

Note: Only one injection mode should be operated for valid measurements.

18 Plug-In The plug-in cavity is the output for AC/Pulse events when using the internal coupler isolation network. There are different plug-in assemblies for different power configurations. For an updated list of these plug-ins, call the manufacture.

The V-3434 comes standard with the V-3300 while the V-3431 or the V-3432 must be ordered separately.

19 EUT Power On/OFF When this yellow button is pushed, a pulse (or repetitive EFT/Bursts) can be injected into the equipment under test via the AC/Pulse output connector J115 on the front panel. When the EUT power is off, the pulse is delivered through the high-voltage output connector (J103). In this case, the capacitive clamp can be used to inject a bundle of wires, as specified in IEC 801-4.

AC line Voltage: Maximum Line voltage to load, 277V RMS, 50/60Hz.
AC Line Current: Maximum continuous current to load 15A RMS.

20 Ground Lug

21 Pulse Output Connector CAUTION: High Voltage in excess of 4kV can appear on the HN Connector. Exercise extreme caution when handling.

A HN Connector, J103 (Velonex part number, 150-0335), is used as pulse output connector and a HN Cable Assembly (Velonex part number, 900-21321) should be used for mating connection.

Rear Panel

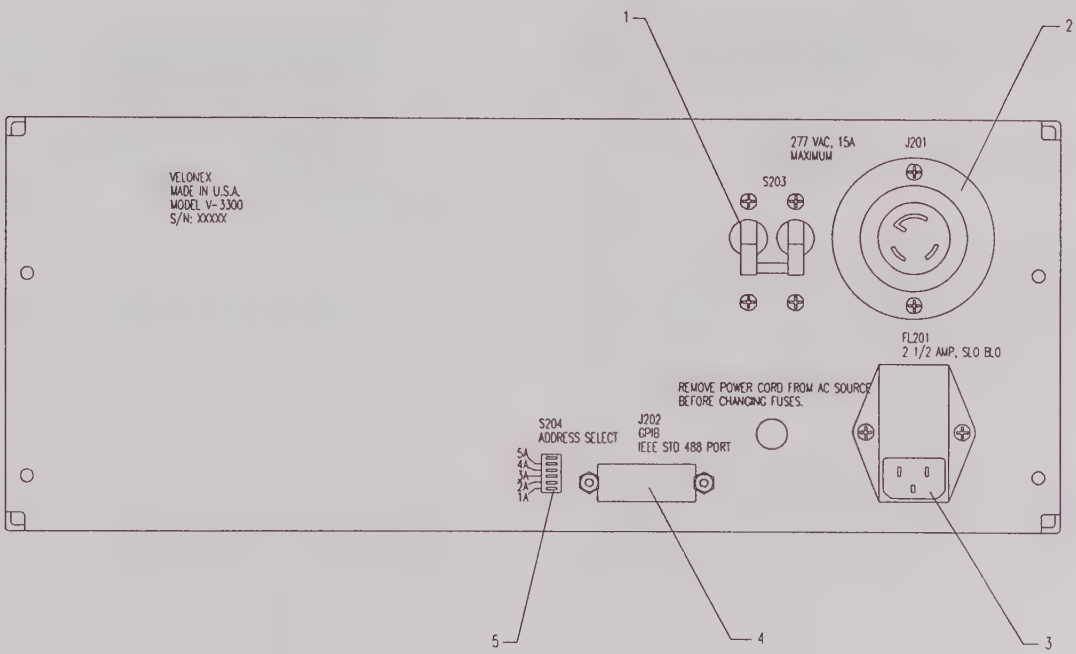


Figure 2 V-3300 Rear Panel

1 EUT Power Reset A magnetic circuit breaker is located on rear panel to protect the EUT from a short circuit failure. The circuit breaker is rated for 15 amperes. If the EUT draws more than 15 amperes, the circuit breaker will create an open circuit. In this case, turn the EUT power off, remove the EUT, then flip the Circuit Breaker up into the on position for EUT power to reset.

2 EUT Power Input The EUT power input is the feed for the internal coupler/isolation network. The power applied at this input connector will be present at the front panel output cavity when the EUT POWER push button is active. The fast transient signal is attenuated at this point to prevent damage to supplementary equipment connect to the same power source that is being feed into the isolation network.

3 Line Power Cable/ Fuse The three conductor power cable of the Model V-3300, ends within a polarized three prong male and female connector. Plug the female end into the Model V-3300 line filter located on the rear panel, then plug the male connector into an AC outlet.

A fuse is used to protect the instrument, and is located in the line filter. In case this fuse blows, remove the fuse and replace it with a SLO-BLO 3A 250VAC fuse. If the fuse blows again consult a qualifed service personnel for a diagnosis.

4 Programming Connector

5 Programming Address Select

Interlocks As a safety feature, the Model V-3300 incorporates active cover interlocks. For the V-3300 to operate both top and bottom interlocks must be closed.

Remote Programming

1 Remote Programming In order to begin programming the V-3300 a basic understanding of the programming theory is required. The V-3300 can be programmed through the GPIB (General purpose interface bus) bus. The V-3300 will accept a string of ASCII character delimited by a carriage return. The string will be analyzed for content and an action will be taken depending on the content.

The string syntax is basically composed of three parts a mnemonic , a colon , and an determining value.

Ex.

AMP:2000	(1)
PER:0150	(2)
LTG:ON	(3)

The mnemonic is a abbreviated representation of a front panel control as in example (1) AMP is an abbreviation for **Amp**litude, in example (2) PER is an abbreviation for Burst **Per**iod, and example (3) LTG is an abbreviation for **L**ine **T**o **G**round injection. Table 2 lists all the acceptable mnemonics.

The determining value can be either a four digit integer or a short word.

The four digit integer is superimposed on the front panel display so no decimal is required. In example (1) 2000 will display a 2000 in the amplitude display so the amplitude would be 2000 volts into a 50 Ω load. Example (2) 0150 will cause 150 to be displayed in the burst period display so the burst period would be 15.0 ms.

The short "word" can be either ON, OFF, P or N depending of the mnemonic preceding. In example (3) the ON value will cause the output to injected onto the Line signal with respect to ground. An OFF value will turn the injection off.

TABLE 2

AMP:XXXX	Output **AMP**litude 0000 < XXXX < 5000
ANG:XXXX	Phase **ANG**le synchronization 0000 < XXXX < 0360 (0 - 360 degrees) A value > 0360 will put the V-3300 into the non-sync mode.
DUR:XXXX	Burst **DUR**ation 0001 < XXXX < 0200 (0.1 - 20 ms)
EUT:ON/OFF	**EUT** Power on or off
HIV:ON/OFF	**HI**gh **V**oltage on or off
LTG:ON/OFF	**L**ine **T**o **G**round injection on or off
NTG:ON/OFF	**N**eutral **T**o **G**ound injection on or off
OSH	Initates **O**ne **SH**ot
PTG:ON/OFF	**P**.E. **T**o **G**round injection on or off
PER:XXXX	Burst **PER**iod 0900 < XXXX < 3300 (90 - 330 ms)
POL:P/N	Output **POL**arity positive or negative
PRF:XXXX	**P**ulse **R**epetition **F**requency0.100 - 5500 KHz 0100 < XXXX < 5500 (0.1 - 5.5 KHz)
STP	**STo**P testing
STR	**STaR**t testing
TST:XXXX	**TeS**t **T**ime 0001 < XXXX < 0990 (1 - 99 seconds) A value > 0990 will put the V-3300 into continuous output mode.

Operating Instructions

The following test severity levels are recommended for fast transient/burst tests per the IEC 801-4(1) Electromagnetic compatibility for industrial-process measurement and control equipment. Refer to ther IEC document for a definition of each test level and it applicability to the product to be tested.

Open Circuit output test voltage ±10%		
Level	On EUT's power supply	On I/O (Input/Ouptut)signal, data and control lines.
1	0.5 kV	0.25 kV
2	1.0 kV	0.50 kV
3	2.0 kV	1.00 kV
4	4.0kV	2.00 kV
X	Special	Special

1 Calibration Verification Operating Instructions

The following describes how to perform calibration testing of the V-3300 fast transient/burst generator for test severity level 2 when testing power supplies.

CAUTION: Do not turn on high voltage until all signal connections have been made.

1. Plug the AC power cord into a 115 VAC, + 10%, 60Hz power source.

2. Connect the Model V-3300 Scope Trigger to the External Trigger of an Oscilloscope.

3. Push the "White" power button and wait four minutes for warm-up time.

4. Select the "frequency" by pushing the frequency select push button, them adjust the frequency with the adjust knob to a value of 5 kHz..

5. Select the "test" time by pushing the test time push button, then adjusting the time with the adjust knob to the continuous mode by increasing the test time value to greater than 99 seconds.

6. Connect a 100x high-voltage probe with at least a 400 MHz bandwith to the output connector(J103).

7. Set the Mode Select switch to the Non-Sync mode If the Non-Sync mode is selected the phase angle will not be enabled.

8. With the "Green" ready-for-test light lit, push the HV-ON button once to turn the high-voltage on. Pressing the high-voltage button again will turn off the high voltage

Caution: Do not touch or otherwise contact the high-voltage output connector, as long as the high voltage is on!

9. Set the output Amplitude by adjusting the Amplitude adjust knob 1000 volts.The displayed value is the approximate peak value into an open circuit.

10. Set the oscilloscope to 20ns/div, 2V/div (if not using a scope which automatically compensates the scope input).

11. To initiate a pulse, press the single shot push button and view the pulse on the oscilloscope. To initiate a series of pulses (burst) continuously, press the green "start" push button.

12. Measure the peak voltage and adjust the voltage with the voltage adjust knob until the peak voltage measures 1.0 kV. The rise time should be 5 ns ±

1.5ns and the width should be approximately 50ns ± 15 ns. It should be noted here that the specification does not describe the open circuit waveform.

13. Stop the generator from initiating a burst, simply press the red stop push button.

14. Turn the high-voltage off by pushing the HV-ON button.

15. Remove the 100x high-voltage probe from the output connector (J103) and connect a coaxial attenuator with at least a 400 MHz bandwith to the output connector(J103). Make sure the attenuator can handle the peak voltage.

16. Push theHV-ON button once to turn the high-voltage on.

17. Measure the peak voltage and record the value to calculate the effective source impedance. The specification describes the calibrated waveform into a 50 Ω coaxial attenuator. This waveform is characterised by a defined risetime and a defined width. The risetime should be 5ns ±1.5 ns measured from the 10% to 90% portion of the leading edge and the width should be 50ns ± 15 ns measured from the 50% point on the leading edge to the 50% of the following edge.

18. To turn all the power off, push the Power button.

To test the E.U.T., follow the procedure below:

19. Remove the 50Ω attenuator.

20. Connect the a ground strap to J102 for grounding the V-3300 chassis to the ground plane.

21. Connect the appropriate line power to the twist lock connector J201 located on the rear panel.

22. Plug the E.U.T.'s power cord into the Plug-In receptacle J115 on the front of the Model V-3300.

23. Press the yellow E.U.T. power to allow power to the E.U.T.

24. Turn the E.U.T. off.

25. Select the required injection mode.

26. With the various burst characteristics selected press start to be testing.

27. When testing is complete, turn off the high voltage. Turn-off power to the Model V-3300.

2 Capacitive Coupling Testing

The following describes capacitive coupling testing of I/O lines with the Velonex models V-3300 generator and the V-3334 clamp. Refer to figure 3 for a connection diagram.

CAUTION: Do not turn on high voltage until all signal connections have been made.

1. Plug the AC power cord into a 115 VAC, + 10%, 60Hz power source.

2. Connect the Model V-3300 Scope Trigger to the External Trigger of an Oscilloscope.

3. Connect the cable assembly (900-21321) between J103 on the V-3300 and J201 on the V-3334. Insure that the each plug is screwed on tightly for signal fidelity.

4. Connect the interlock cable assembly (900-21350) between J104 on the V-3300 and J203 on the V-3334. Each plug must be snapped into its appropriate mating connector in order for the HV interlock to be satisfied.

5. Open the cable channel by lifting the three snap levers up and sliding the channel cover back with the provided handles. Place the EUT's cable to test in the channel and close the channel cover down around the EUT's cable for a snug fit. Push the snap levers down to secure the channel cover in place.

6. Place the protective plastic shield around the capacitive coupling clamp while lining up the interlock magnet with the magnetic switch. Failure to proper line up the magnet with the switch will prevent proper closure of the HV interlock.

7. Push the "White" power button and wait four minutes for warm-up time.

8. Select the desired frequency by pushing the frequency select push button, them adjusting the frequency with the adjust knob.

9. Select the burst duration by pushing the burst duration push button, then adjusting the duration with the adjust knob

10. Select the burst period by pushing the burst period push button, then adjusting the period with the adjust knob.

11. Select the test time by pushing the test time push button, then adjusting the time with the adjust knob.

Note:If a continuous test is desired, increase the test time to more than 99s. In this case, a continuous burst can be initiated if the green "start" button is pressed.

12. Select the burst polarity, either positive or negative, by pushing the polarity push button. An LED will light indicating the polarity selected.

13. Set the Mode Select switch to Non-Sync.

14. With the "Green" ready-for-test light lit, push the HV-ON button once to turn the high-voltage on. Pressing the high-voltage button again will turn off the high voltage.

Caution: Do not touch or otherwise contact the high-voltage output connector, as long as the high voltage is on!

15. Set the output Amplitude Control to the desired output. The displayed value is the peak value into a 50Ω load.

16. To initiate a pulse, press the single shot push button and view the pulse on the oscilloscope. To initiate a series of pulses (burst) continuously, press the green "start" push button.

17. To stop the generator from initiating a burst, simply press the red stop push button.

18. To turn the high-voltage off, push the HV-ON button.

19. To turn all the power off, push the Power button.

3 Additional Caution Notes This instrument uses air convection for proper internal cooling. Do not restrict the air flow in any way.

In order to prolong the life of the components within the Model V-3300, turn the high-voltage off when the instrument is not in use. The instrument should not be left operating with a continuous trigger when not required.

Circuit Descriptions

1 . General Information The Velonex Model V-3300 is a Thyratron based design that incorporates a built-in coupler/isolation network for line injection. The Model V-3300 uses circuitry to determine the pulse width, rise and decay times. The PRF, burst duration, burst period, phase angle and test time are fully microcomputer controlled. The selection of each parameter can be selected by front panel push buttons (See Figure-4). The pulse switching networks of the generator are not field serviceable. Schematic diagrams of these parts are not included. If any problem arises, please contact Velonex.

2 Power-On Circuits When the Power switch (S101) closes, transformers T201, T205, and T1101 are energized. The secondary windings of transformer T205 supply power to the mosfet driver and 24 volts DC power supply CR202, R1101, R1102 and C1101 to operate relays K801 thru K806. The secondary windings of transformer T1101 will supply a negative bias voltage of 130V DC to hold off the anode voltage. The secondary windings of T1102 will supply a positive voltage of 5.25 volts DC at 1.5 amps to the reservoir heater of the thyratron. The secondary windings of T201 will energize the primary windings of T204, in turn secondary windings of T204 will be energized and supply a positive voltage of 6.8 volts to the cathode heater through the diode bridge CR201, C201 and R201. Primary power is also supplied to power supply modules PS201 and PS202 (P-26) to operate the digital panel meters and the microcomputer circuitry.

3 GRIDS Drive Circuitry To achieve full performance capability of the Thyratron, the drive pulses should be optimum. GRID 1 is driven by one mosfet device. A TTL level, trigger 1, drives Z601A in turn drives Z602A. Transformer T601 is a pulse transformer that is used to isolate the TTL level voltage from the 800 volts supply. The peak GRID 1 output voltage is about 800 volts. GRID 2 is also driven by one mosfet device. TRIG2, a TTL level trigger, drives Z601B and in turn drives Z602B. Transformers T101C is used to isolate the TTL level voltage from the 800 volt supply. The peak GRID 2 output voltage is also about 800V. A negative bias of 130 volts sits on the 800 volt grid 2 pulse as to hold off the anode voltage. The GRID 2 trigger pulse is delayed relative to GRID 1 pulse to allow the discharge to become established.

4 HV-ON Circuitry When the HV-ON momentary switch S101 is pressed, relay K1501 will activate and transformers T202, T203 and T206 (Variac) are energized. The secondary windings of T202 supply voltage to the anode of the Thyratron up to 5kV through R1601, C1601, CR1601, CR1602 and C1602. The resistor network RN1601 acts as a bleeder network for C1602. The variac (T206) center tap is connected to T202 as to increase or decrease the AC potential difference from 0 to 5kV across the anode of the Thyratron. The secondary windings of T203 supply 800 volts to the drain of the GRIDS mosfets through the diode bridge CR301 and capacitors C301 and C302. The resistor network RN301 acts as a bleeder network for C301 and C302.

5 Power Supplies The Model V-3300 uses seven DC power supplies:

1. A 800V power supply for the GRID Trigger supply. This power supply is a regulated, positive 800 volt DC source utilizing CR301, C301, C302 and RN301.

2. A 6.8V power supply for the cathode heater. This power supply is regulated through transformers T201, positive 6.8 volt DC source using T204, CR201, C201 and R201.

3. A 30V power supply for the power control relay circuitry. This power supply is an unregulated positive 24 volt DC source utilizing T205, CR202, R1101, R1102, C1101 and C1102.

4. A 18V power supply for the mosfet driver supply. This power supply is regulated, positive 18 volt DC source employing IC regulator Z402 and associated components C403, R404, R405, R406 and C404.

5. A 5.3VDC power supply for the reservoir heater of the Thyratron. This power supply is regulated, positive 5.3 volts DC source employing IC regulator Z401 and associated components T1102, CR401, C401, R401, R402, R403, and C402.

6. A 130VDC power supply for the GRID 2 bias of the Thyratron. This power supply is regulated negative 130 volt DC source employing IC regulator Z403 and associated components T1101, CR40-3, C405, R407, R408, R409 and C406.

7. A 5.0VDC power supply for the control logic. This power supply is regulated, employing two switching supplies (P201, P202).

6 Coupler/Isolation Filter Section Refer to Figure-12 for the following circuit description. The coupler/isolation filter employs ceramic vacuum relays for switching the surge injection and polarity. Depending on the front panel selected injection mode, the appropriate relay is activated by the microcontroller circuitry. K801 and K802 are used to ground either output from the Thyratron and Pulse Forming Circuit which allows positive and negative pulses. K803 is employed to direct the pulses either to the direct HV output or to the coupler/isolation network. K804, K805 and K806 are used to couple the pulses through coupling capacitor networks (CN801, CN802 and CN803). Inductors L1001, L1002, L1003 are used to block the pulses from being injected into the AC mains while allowing the AC power to get to the E.U.T. After the EUT AC power has been connected to J201, relay K1201 switches the electrical connection from J201 to the coupler/isolation network. CB101 and CB102 are circuit breakers which limit the network current to 15A because of thermal heating in the isolation network. At J115, the E.U.T. is exposed to the AC power and the output pulse.

7 Thyratron and Pulse Forming Circuit These are not shown. Please see explanation in Section 3.1.

8 Digital Control Circuit The digital control circuits are comprised of these sections: the controller card (Figure-8), the logic mother board (Figure-9), the front panel board (Figure-10). The controller card's main function are reading the front panel push buttons, determining the required action, setting timing chips and relays to appropriate value and lastly updating the displays. The mother boards primary function is power distribution, signal routing, relay driving and trigger driving. The front panel board's primary function is refreshing discrete LED's, opto-coupling the push buttons to the logic supply level and creating the trigger pulse output.

9 Controller Card The controller card is controlled centrally by a micro-controller U1405 which contains the system software. The micro-controller accessed other chips using port C and U1413. Data from the front panel keyboard matrix is stored in U1414 and is read by U1405 after U1414 interrupts signaling a change on the front panel. U1407 and U1411 are timer chips which control the timing and are always running. U1406 sends data to control the output for either non-synchronized or line synchronized output, one shot, starting and stopping, and also HV-ON. The trigger output from U1401 goes to U1412 where it is gated by U1406. The signal from U1412 feeds from U1403B which drives the scope trigger and the grid driver circuits. U1401 and U1404 are decoding chips which read the data from R101, a digital pot, and translates it to a parallel out where U1405 (the micro-controller) can read the data. U1402 is a comparator which is used for the zero-crossing circuit which is fed to U1407 for line synchronization.

10 Logic Mother Board The logic mother board has multi-functions. Circuit designations U1301 and U1302A are used for creating a delay time between grid 1 and grid 2. U1307 and U1308 are outputs which drives the grid driver board on Figure-11. U1303, U1304, U1305 and U1306 are used to drive the instrument relays and there outputs are designated on the right side of the schematic. Connector J1301 and J1302 are in parallel for an additional plug-in card. J1303 and J1304 are for power distribution. J1302 and J1303 are for signal connections between the logic mother board and the front panel board.

11 Front Panel Board The front panel board has three main functions. The LED display are driven from the serial output from the controller card. Each chip, U1802-U1806, individually drives each display D1801-D1805. U1801 drives all the discrete LED's as directed by the controller card. The signals front the logic mother board which control the front panel lights are routed on this board for easy termination Z1801-Z1803 are opto-couplers which connect the front switches to the controller card. R101, the digital pot on the front panel, is plugged into connectors J1804 and J1805 where the signal is sent to the controller card. Q1801 and T1801 comprise the scope trigger function which has an isolated output.

Maintenance

1 Servicing Before attempting to service this instrument, study the circuit descriptions of Section 3.

2 Cooling The Model V-3300 utilizes convection cooling. A vent is on the bottom of the cabinet, the bottom and rear of the cabinet must be clear of obstructions.

3 Cabinet Removal Remove the four screws from the front panel (two on each side), and the four screws (two on each side) holding the rear mounting brackets to the chassis. Slide the instrument forward to clear the cabinet.

4 Top Cover Removal Remove the sixteen fathead screws. Removal of the top cover opens interlock switch S202.

5 Bottom Cover Removal Remove the sixteen flathead screws. Removal of the bottom cover opens interlock switch S201.

6 Cleaning Periodically inspect the instrument for dust accumulation. Clean with a vacuum cleaner or dry air under moderate pressure.

7 Panel Lights The Panel Lights; POWER ON, READY FOR TEST, and HV-ON, are replaceable from the front panel by snapping out the translucent cover from each light. Chicago miniature number 327, 28 volt bulbs are used. If any indicator light becomes dim, replace it to prevent the possibility of having high-voltage on in the absence of the red indicator lights. Panel lamp replacement may be facilitated by the use of a lamp tool (Microswitch type 15PA19 tool is recommended).

8 Fuse and Circuit Breakers A fuse is used to protect the instrument. The fuse is located on the rear panel of the instrument rated at 0.5 amps, and is used to protect the HV DC power supply. Should this fuse fail, remove and replace with the same type fuse. Two more circuit breakers are located on the back panel. These two circuit breakers are used to protect the EUT and are rated at 15 amperes. In case of EUT short circuit failure or if any of the circuit breakers pop out, remove the EUT and push the failed circuit breaker to reset it.

9 Interlocks Two interlocks are provided for safety, one on each of the chassis top and bottom covers.

10 Instrument Failure By carefully observing the symptoms and by referring to the schematic diagrams, most problems can be pinpointed quickly to a particular circuit. If a problem can't be solved, call the Velonex service department. Do not ship an instrument back without a Return Merchandise Authorization (RMA) number.

Velonex
560 Robert Avenue
Santa Clara, CA 95050
(408) 727-7370
FAX: (408) 727-0389

Replaceable Parts List

The following lists the replaceable parts used in the Model V-3300 Surge Transient/Burst Generator. Circuit reference designations, where applicable, refer to the schematic diagrams in Section 6. Replacement parts should be ordered by specifying the entire Velonex part number.

Circuit Designation:	Description:	Velonex Part No.
1 Resistors: (Unless otherwise specified all resistors are in ohms, 1/4 watt, +5%.)		
R1	3.3k, 1% SMD	093-0095
R101-102	Digital Potentiometer	094-0098
R201	0.03, 11W	094-0113
R301	10, 1/2W	091-0012.015
R302-313[1]	1M, 2W (RN301)	091-0020.135
R401, R402	100, 1%	600-365
R403	402, 1%, ½W	093-0002.088
R404	100	094-0117
R405	301, 1%, ½W	093-0002.076
R406	2k, 1%, ½W	093-0002.155
R407	50k, ¼W	094-0018
R408	150k, 1%, ½W	093-0002.335
R409	8k, 5W	092-0016
R501	5k, 14.5W	092-0031
R502-505[1]	4.3k, 2W (RN501)	091-0020.078
R506-509[1]	4.3k, 2W (RN502)	091-0020.078
R510-520[1]	220, 2W (RN504)	091-0020.047
R521-522	1k, 2W	091-0020.063
R523	5k, 14.5W	092-0031
R524-527[1]	4.3k, 2W (RN503)	091-0020.078
R528-532[1]	510, 2W (RN505)	091-0020.056
R1101	2, 10W	094-0112
R1301	100	091-0008.039
R1302	510	091-0008.056
R1303	Pot, 50k	094-0101
R1401	100k	091-0008.111
R1402	4.7k	091-0008.079
R1403-1404	10k	091-0008.087

1. Part of a resistor network.

Circuit Designation:	Description:	Velonex Part No.
R1405	4.7k	091-0008.079
R1406	56k	091-0008.105
R1407	510	091-0008.056
R1408	3.3k	091-0008.075
R1409	820k	091-0008.133
R1410	Pot, 500k	094-0114
R1411	10k	091-0008.087
R1601	10, 2W	091-0020.015
R1602-16091	1M, 2W	091-0020.135
R1801-1802	3.3k	091-0008.075
R1803-1806	100	091-0008.039
R1807	3.3k	091-0008.075
R1808-1811	910	091-0008.062
R1812-1815	10k	091-0008.087
R1816	3.3k	091-0008.075
R1817-1820	1.2k	091-0008.065
R1821-1822	220	091-0008.047
R1823	1k	091-0008.063
R1824	51	091-0008.032
R1825	75	091-0008.036
R1826	3.3k	091-0008.075
R1827	1.2k	091-0008.065
R1828-1832	220	091-0008.047
R1833	1k	091-0008.063
R1834	330	091-0008.051
R1835	470	091-0008.055
R1901	33k, 1W	091-0016.099
R1902	Pot, 50k	094-0093
R1903-1912	1M, 2W	091-0020.135

2 Capacitors: (All values in µf, +20%, except where otherwise noted.)

C201	33k, 15V	105-0136
C202	5, 270V	PART OF T201
C301-302	0.5, 1000V	102-0095
C401-402	1000, 35V	105-0124
C403-404	470, 63V	105-0132
C405-406	250, 150V	105-0059
C407	1000, 35V	105-0124
C501-5051	0.1, 1.5kV (CN501)	103-0026
C5061	250pF, 1.5kV (CN501)	103-0023

1. Part of a resistor network.

Circuit Designation:	Description:	Velonex Part No.
C507	0.1, 1kV	102-0087
C508-5121	500pF, 1.5kV (CN502)	103-0026
C5131	250pF, 1.5kV (CN502)	103-0023
C514	0.1, 1kV	102-0087
C515-5161	0.05, 500V (CN503)	101-0002.029
C801-8031	0.01, 3kV (CN801)	101-0005
C804-8061	0.01, 3kV (CN802)	101-0005
C807-8091	0.01, 3kV (CN803)	101-0005
C1001-1002	0.22, 400V	102-0020
C1101-1102	1000, 63V	105-0133
C1301	100pF, 500V	103-0001.027
C1302-1303	0.01, 50V	101-0066
C1304-1308	0.1, 50V	101-0047
C1309	100, 16V	105-0122
C1310-1311	100, 50V	105-00173
C1401-1405	0.01, 50V	101-0066
C1406-1407	6.8, 35V	104-0006.039
C1408-1409	0.01, 50V	101-0066
C1411-1415	0.01, 50V	101-0066
C1416	0.1, 50V	101-0047
C1417	0.01, 50V	101-0066
C1418	3.3, 15V	104-0004.015
C1419-1425	0.01, 50V	101-0066
C1426	6.8, 35V	104-0006.039
C1427-1438	0.01, 50V	101-0066
C1601	0.5, 3kV	106-0020
C1602	2, 7.5kV	106-0060
C1801-1808	0.01, 50V	101-0066
C1809	220pF, 500V	103-0001.035
C1810-1811	0.01, 50V	101-0066

3 Diodes:

CR101	LED, Green	111-0197
CR102-104	LED, Yellow	111-0198
CR105-106	LED, Amber	111-0192
CR201-202	Bridge	111-0100
CR301-304	4kV, 250mA	111-0127

1. Part of a capacitor network.

Circuit Designation:	Description:	Velonex Part No.
CR401-402	Bridge	111-0218
CR403-404	Bridge	111-0069
CR405	Silicon, 1A, 200V	111-0062
CR406	Tranzorb 5V	111-0196
CR801-812	Fast Recovery	111-0124
CR1201	Silicon, 1A, 200V	111-0062
CR1401-1402	Signal	111-0003
CR1501	Silicon, 1A, 200V	111-0062
CR1601-1604	4kV, 250mA	111-0127
CR1801	Signal	111-0003

4 Transistors:

Q601-602[1]	FET Switch Assembly	900-21308
Q901-908	Mosfet N-channel	112-0153
Q1801	NPN	112-0001

5 Switches:

S101-102	DPDT, Moment	131-0003
S103-106	Push Button, SPDT, Moment	131-0103
S107-108	SP3T	131-0105
S109-116	Push Button, SPDT, Moment	131-0103
S117	SP3T	131-0105
S118	DPDT	131-0001
S201-202	Interlocks, Top & Bottom	131-0006

6 Transformers:

T201	Constant Voltage, 12V @ 8A	142-0147
T202	High Voltage	142-0137
T203	High Voltage	142-0040
T204	Filament, 7.5V	142-0139
T205	100VA	142-0137
T206	Variac	142-0112
T401	8V, 1.25A SEC 115/230 PRI	142-0141
T402	60V, .16A SEC 115/230 PRI	142-0140

1. Parts not replaceable, must replace entire assembly.

Circuit Designation	Description:	Velonex Part No.
T1101	60V	142-0014
T1102	6.3V	142-0141
T1301	Pulse	900-2442
T1701	Transformer	142-0014
T1801	Pulse	900-2442

7 Panel Lamps:

I101-108	Lamps, 28V, 0.04A	280-0009

8 Integrated Circuits:

Z401	Regulator	113-0182
Z402	Regulator	113-0154
Z403	Regulator	113-0183
Z404	Regulator	113-0173
Z405	Regulator	113-0187
Z406	Regulator	113-0155
Z407	Regulator	113-0015
Z501	Inverter	113-0184
Z601	1C SMD CMOS PWR Musfet drivr	113-0172
Z1801-1803	Quad, Opto-Isolator	113-0156
Z2401	8 bit D/A	113-0179
Z2402	OP amp	600-895
U1301	Dual Monostable	113-0096
U1302, U1309	Hex Inverter	113-0104
U1303-1304	Relay Driver	113-0119
U1305	Octal 3-State Latch	113-0165
U1306	Relay Driver	113-0119
U1307-1308	FET Driver	113-0150
U1310	Regulator +12V	113-0181
U1311	Regulator +18V	113-0183
U1401	HP Quad DEC/CT	113-0122
U1402	Comparator	113-0097
U1403	Monostable	113-0096
U1404	HP Quad DEC/CT	113-0122
U1405	Microcontroller	113-0171
U1406	Octal 3-State Latch	113-0165
U1407	Counter/Timer	113-0169

Circuit Designation:	Description:	Velonex Part No.
U1408-1409	Hex Inverter	113-0116
U1410	Quad or Gates	113-0100
U1411	Counter/Timer	113-0169
U1412	Quad and Gates	113-0095
U1413	8 Bit Decoder	113-0118
U1414	Keyboard/Display Int.	113-0170
U1801	Octal 3-State Latch	113-0165
U1802-1806	Multiple LED Display Driver	113-0153
U2301	GPIB Interface	113-0174
U2302	Interface tranceiver	113-0175
U2303	Interface tranceiver	113-0176
U2304	Data buffer	113-0177
U2401	I/O buffer	113-0178
U2402	Inverter	113-0116
X1401	Crystal Oscillator	113-0167
X1402	Crystal Oscillator	113-0168

9 Relays:

K201, K202	Relay, High Current 40A	132-0070
K401	DPDT	132-0062
K801-803	SPDT, 5kV	132-0068
K804-806	SPST, 10kV	132-0044
K1201	DPDT	132-0062
K1501	DPDT	132-0062

10 Fuses:

F201	0.5 AMP, SLO-BLO	270-0001.14

11 Connectors:

J102	BNC	150-0098
J104	Miniature Recpectacle	150-0345
J108-109	Socket, Red	150-0010
J110	Socket, Black	150-0009
J115	Flanged Nylon Outlet	150-0377
J1151	Plug-In Assembly	900-21196
J201	Flanged Inlet	150-0378
JP201	4 Pin, socket housing conn.	150-0379

Circuit Designation:	Description:	Velonex Part No.
J301	5 Pin Header	150-0330
J401,2,3,6,7,8	6 Pin Header	150-0365
J405	12 Pin Header	150-0369
J501	8 Pin Header	150-0333
J801	12 Pin Header	150-0291
J1101	12 Pin Header	150-0291
J1301-1302	72 Pin Connector	150-0234
JP1301-1302	20 Pin Header	150-0305
JP1303-1304	6 Pin Header	150-0292
JP1305	12 Pin Header	150-0291
J1601	5 Pin Header	150-0330
JP1801-1802	20 Pin Header	150-0305
JP1803	6 Pin Header	150-0292
JP1804-1805	10 Pin Header	150-0304
J2202	2 Pin plug	150-0389

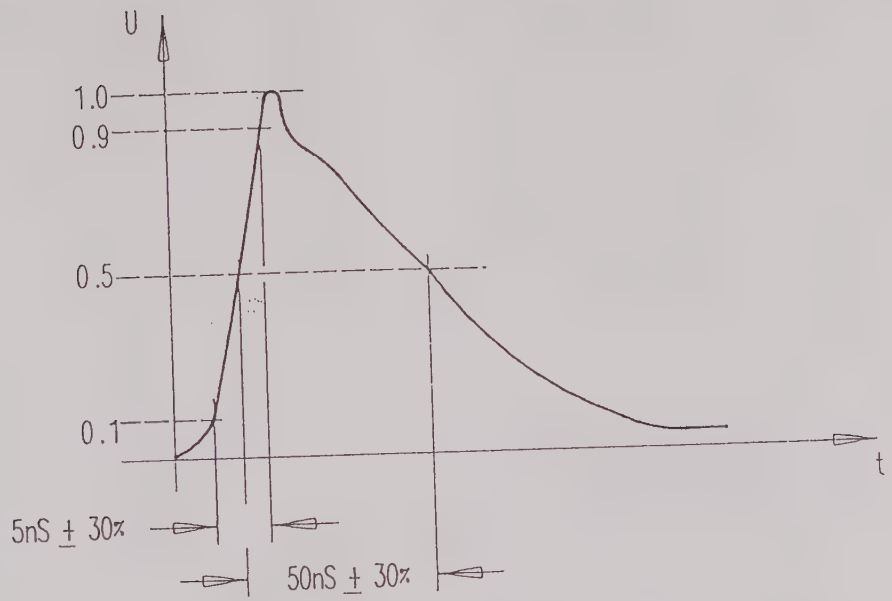
12 Miscellaneous:

B201	Fan, 115V	300-0013
B202	Fan, 115V	300-0011
B401	Fan, 115V	300-0013
CB101-102	Circuit Breaker, 15A	131-0120
CB201	Circuit Breaker 277VAC, 15A	270-0039
D1801-18051	Displays	900-21282
FL201	Line Filter, 230VAC	150-0220
I101-108	Lamp 28V, 0.04A	280-0009
L1-L3	Core Assy	900-21519
L204	Core	037-0036
L1001-1002	Coupling Inductor Assembly	900-21236
L2201	Coupling Inductor Assembly	900-21236
M101	Digital Panel Meter	900-21553
P101	10 Pos Receptacle Plug	150-0313
P104	Female Microphone Plug	900-21628
P201	Socket Housing, 4 Pin	150-0379

Circuit Designation:	Description:	Velonex Part No.
P401,2,3,6,8	Connector 6 Pin Plug	150-0366
P1804, P1805	10 Pos Receptacle Plug	150-0313
S201-202	Interlock Switch	131-0006
TB1001	Terminal Block	150-0374
	Connector, 227V, 15A	150-0323
	Plug, 227V, 15A	150-0324
	Discharge Assembly 1	900-21238
	Charging Assembly 1	900-21247
	Transformer 1	900-21275
	Ground Plane Plug & Strap Assembly	900-21320
	Coaxial HV Cable Assembly	900-21321
	Ground Plane Assembly	900-21353

1. Propreitary parts, part of Discharge Circuit (Figure-12).

Illustrations



WAVESHAPE OF A SINGLE PULSE INTO A 50Ω LOAD

FIGURE-1A

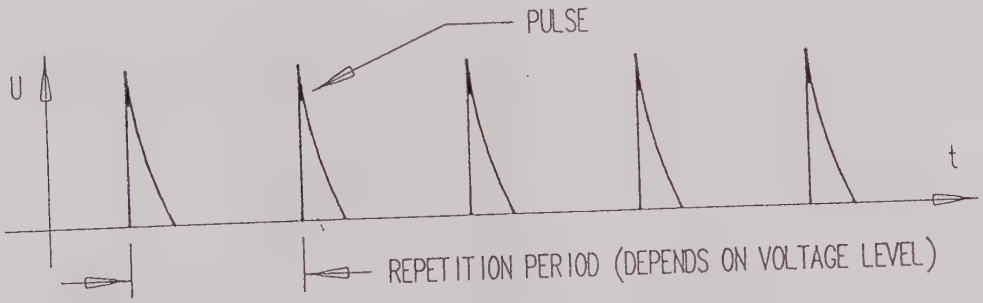
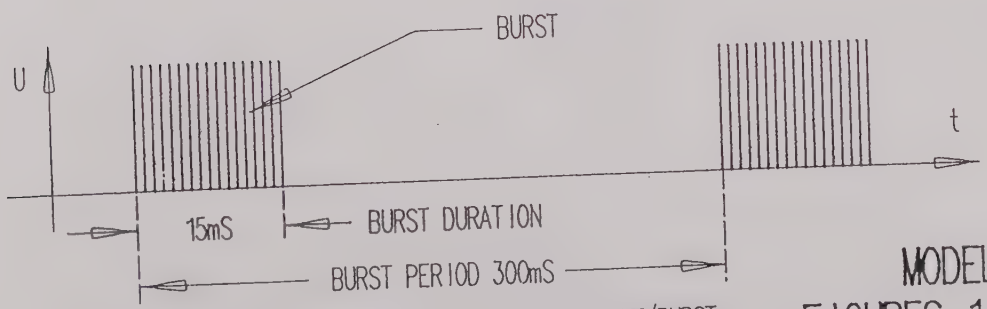


FIGURE-1B

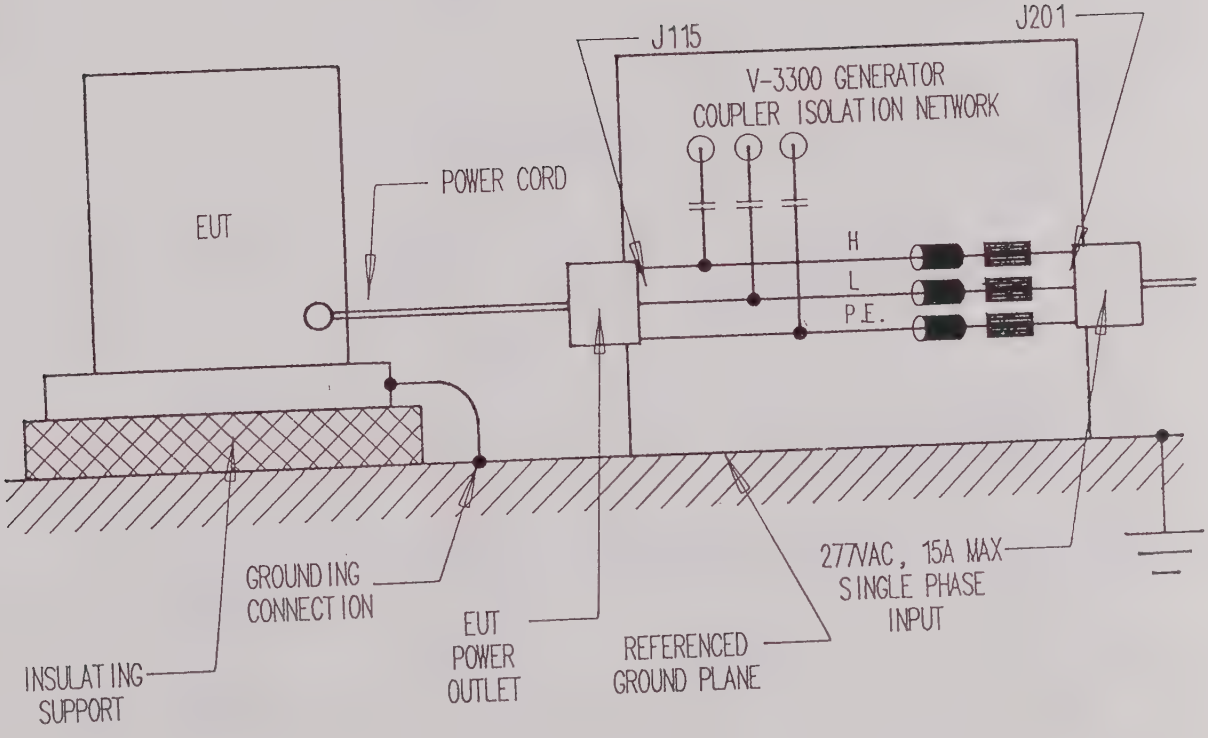


GENERAL GRAPH OF A FAST TRANSIENT/BURST

FIGURE-1C

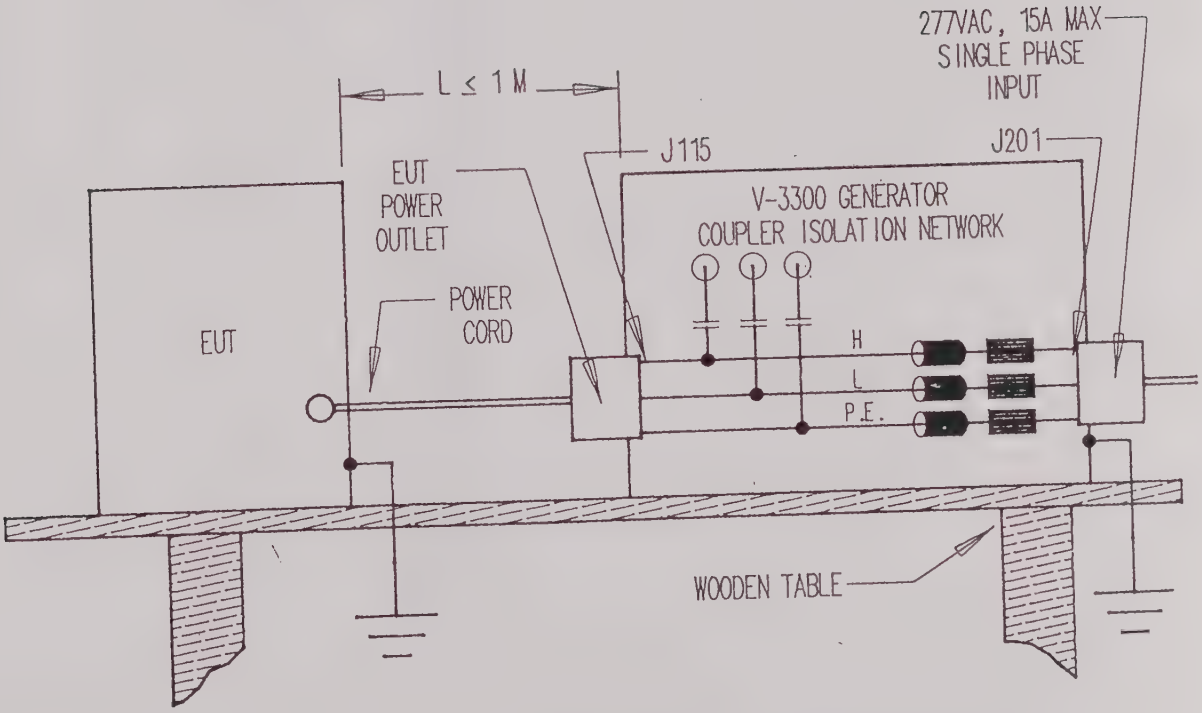
MODEL V-3300
FIGURES 1A, 1B AND 1C
WAVESHAPES

3/91



TEST SET-UP FOR STATIONARY MOUNTED EUT

MODEL V-3300
FIGURES-2A
TEST SET-UP
3/91



TEST SET-UP FOR NON-STATIONARY MOUNTED EUT

PROTECTIVE EARTH
ACCORDING TO
SYSTEM INSTALLATION.

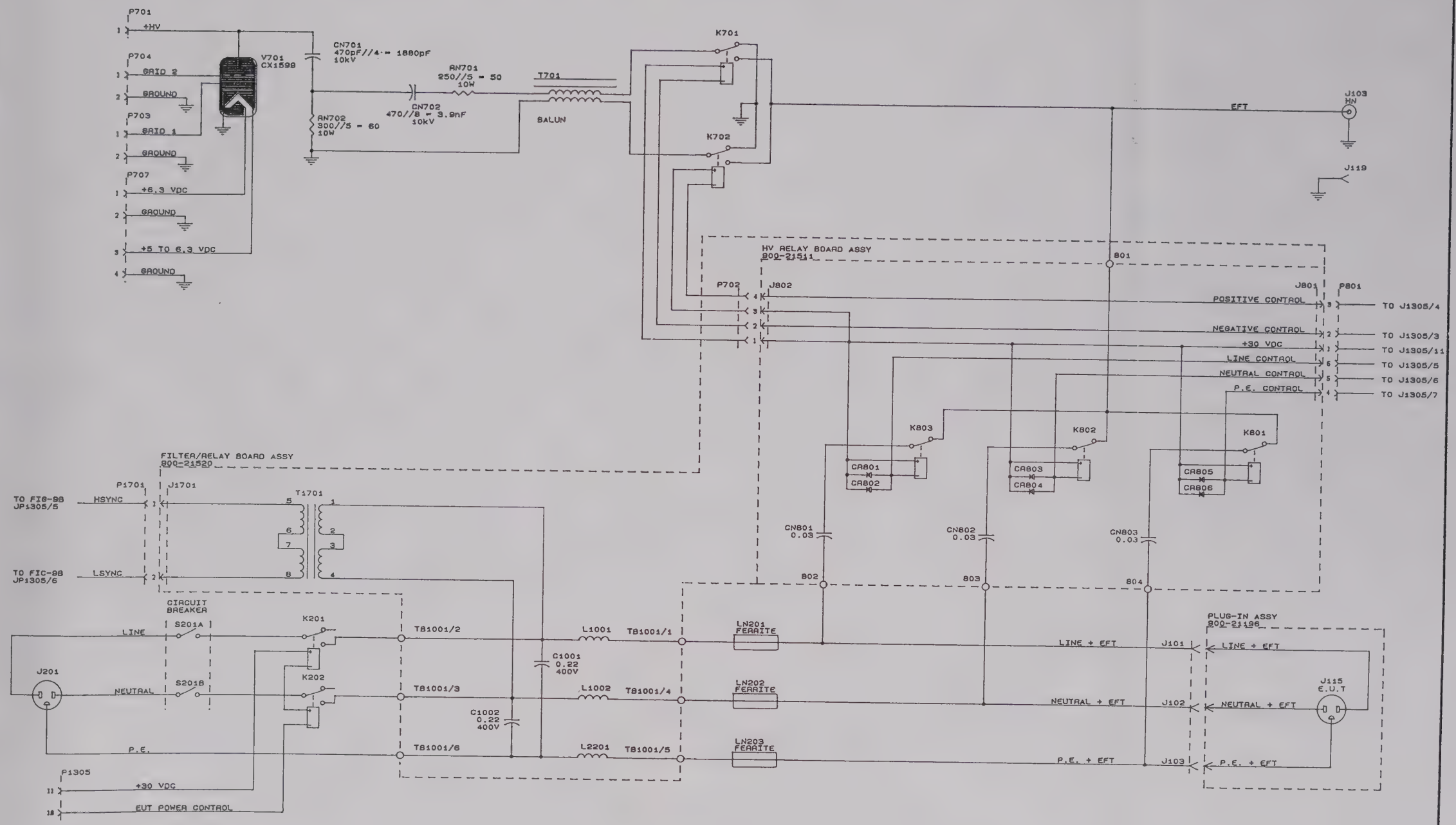
MODEL V-3300
FIGURES-2B
TEST SET-UP

3/91

H.V. ON	POLARITY	E.U.T. POWER	MODE	K801	K802	K803	K804	K805	K806	K1201	K1501
OFF	POS	ON	L2G	1	0	1	1	0	0	1	0
			N2G	1	0	1	0	1	0	1	0
			PE2G	1	0	1	0	0	1	1	0
		OFF	L2G	1	0	0	1	0	0	0	0
			N2G	1	0	0	0	1	0	0	0
			PE2G	1	0	0	0	0	1	0	0
	NEG	ON	L2G	0	1	1	1	0	0	1	0
			N2G	0	1	1	0	1	0	1	0
			PE2G	0	1	1	0	0	1	1	0
		OFF	L2G	0	1	0	1	0	0	0	0
			N2G	0	1	0	0	1	0	0	0
			PE2G	0	1	0	0	0	1	0	0
ON	POS	ON	L2G	1	0	1	1	0	0	1	1
			N2G	1	0	1	0	1	0	1	1
			PE2G	1	0	1	0	0	1	1	1
		OFF	L2G	1	0	0	1	0	0	0	1
			N2G	1	0	0	0	1	0	0	1
			PE2G	1	0	0	0	0	1	0	1
	NEG	ON	L2G	0	1	1	1	0	0	1	1
			N2G	0	1	1	0	1	0	1	1
			PE2G	0	1	1	0	0	1	1	1
		OFF	L2G	0	1	0	1	0	0	0	1
			N2G	0	1	0	0	1	0	0	1
			PE2G	0	1	0	0	0	1	0	1

1 = Relay Closed
0 = Relay Open
L2G = Line to Ground
N2G = Neutral to Ground
PE2G = Potential Earth to Ground

Model V-3300
Figure-14
Relay Table



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE 2W AND IN OHMS.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS.
3. ALL WAVEFORM MEASURMENT ARE MADE WITH RESPECT TO GROUND.
4. ELECTRICAL CONNECTION TO THE GROUND REFERENCE PLANE SHALL BE THROUGH THE CHASSIS GROUND CONNECTOR J119.
5. 30VDC POWER SUPPLY IS FROM FIG-7.

PLUG SIDE ← BOARD SIDE

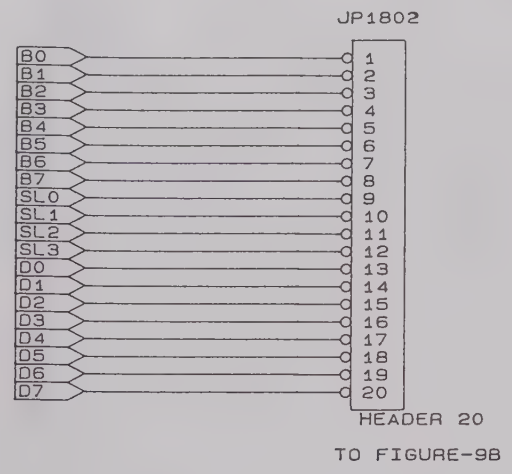
VELONEX

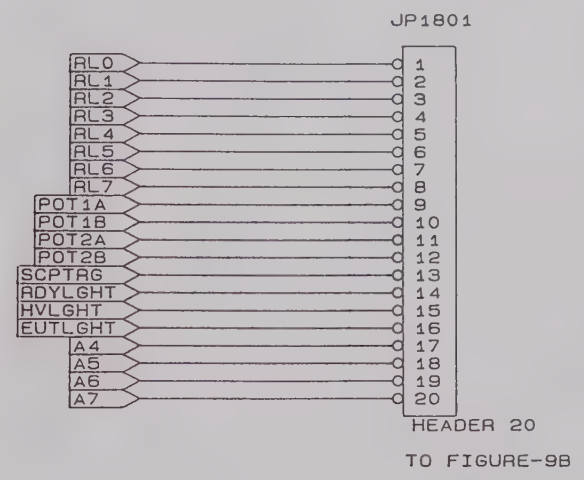
MODEL V-3300

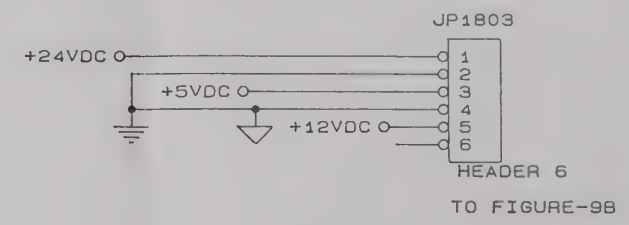
DISCHARGE/COUPLER SCHEMATIC DIAGRAM

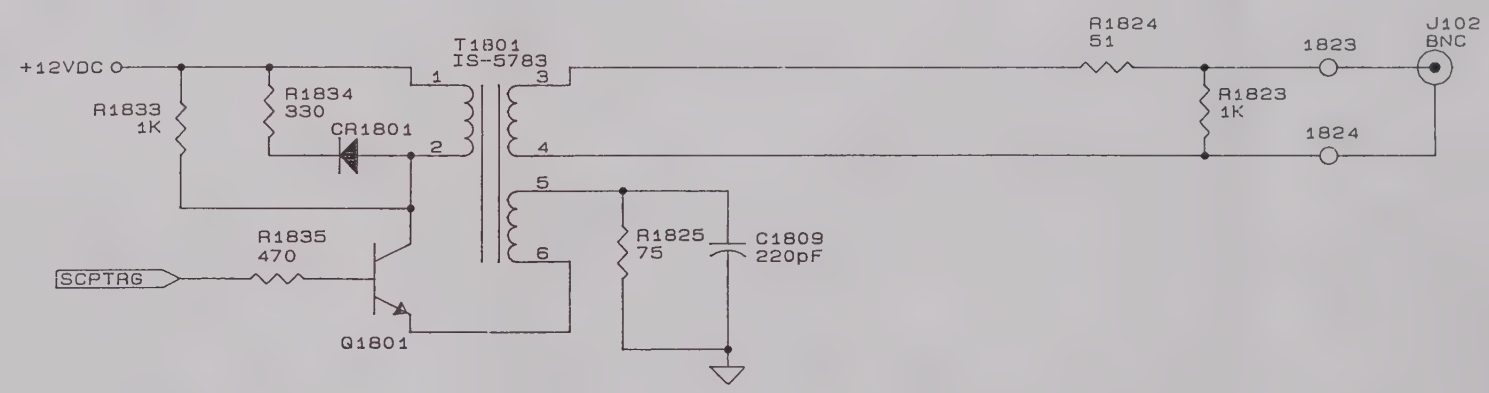
FIGURE 14

3300_14.SCH 8/92









NOTES:
1.UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4W, 5%, IN OHMS.

2.UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE 20% IN MICROFARADS.

VELONEX

MODEL V-3300

FRONT PANEL BOARD CONNECTORS SCHEMATIC DIAGRAM

FIGURE 10C

3300_10C.SCH 2/92

FIGURE-10A

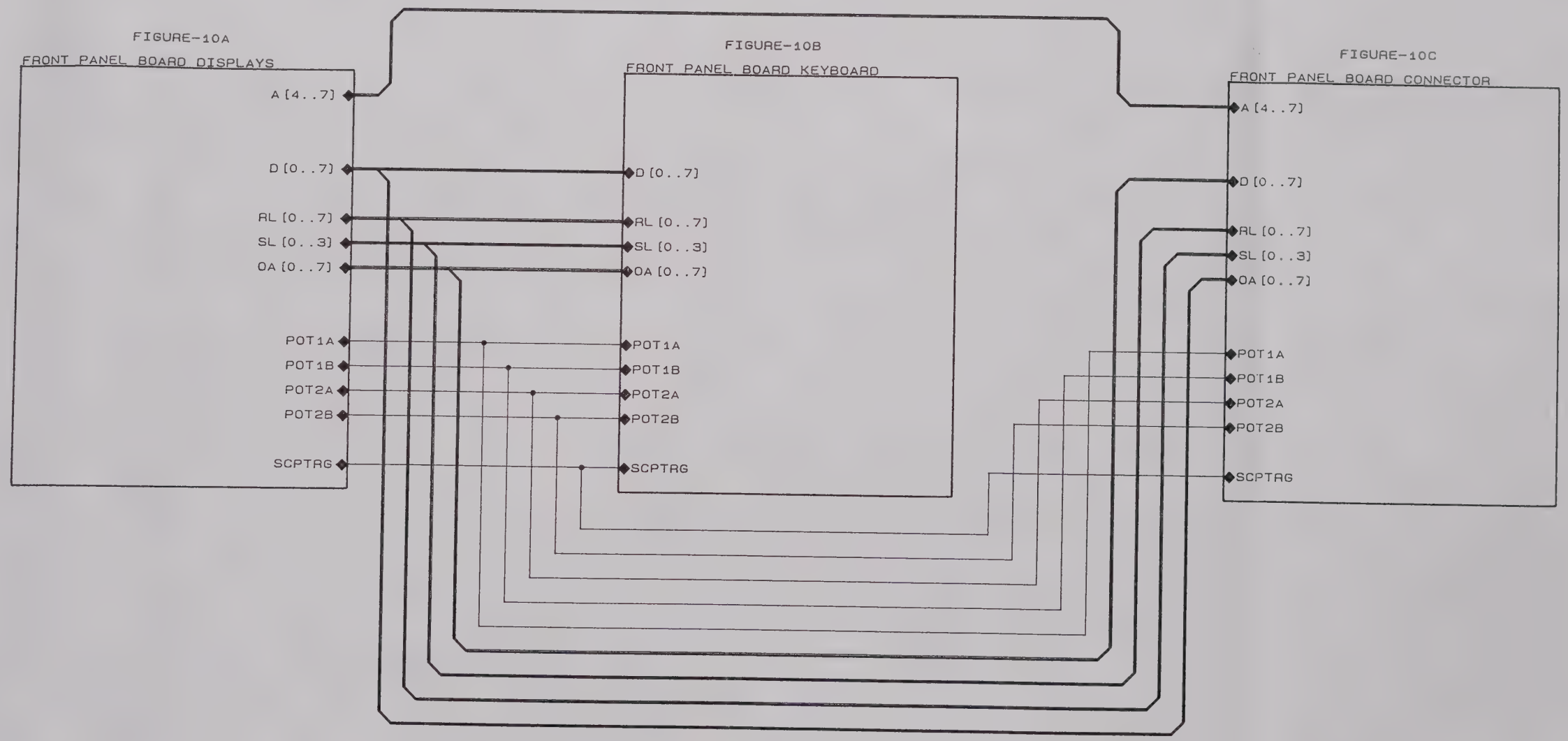
FRONT PANEL BOARD DISPLAYS

FIGURE-10B

FRONT PANEL BOARD KEYBOARD

FIGURE-10C

FRONT PANEL BOARD CONNECTOR



VELONEX

MODEL V-3300

FRONT PANEL BOARD
SCHEMATIC DIAGRAM

FIGURE 10

V3300_10.SCH 2/92

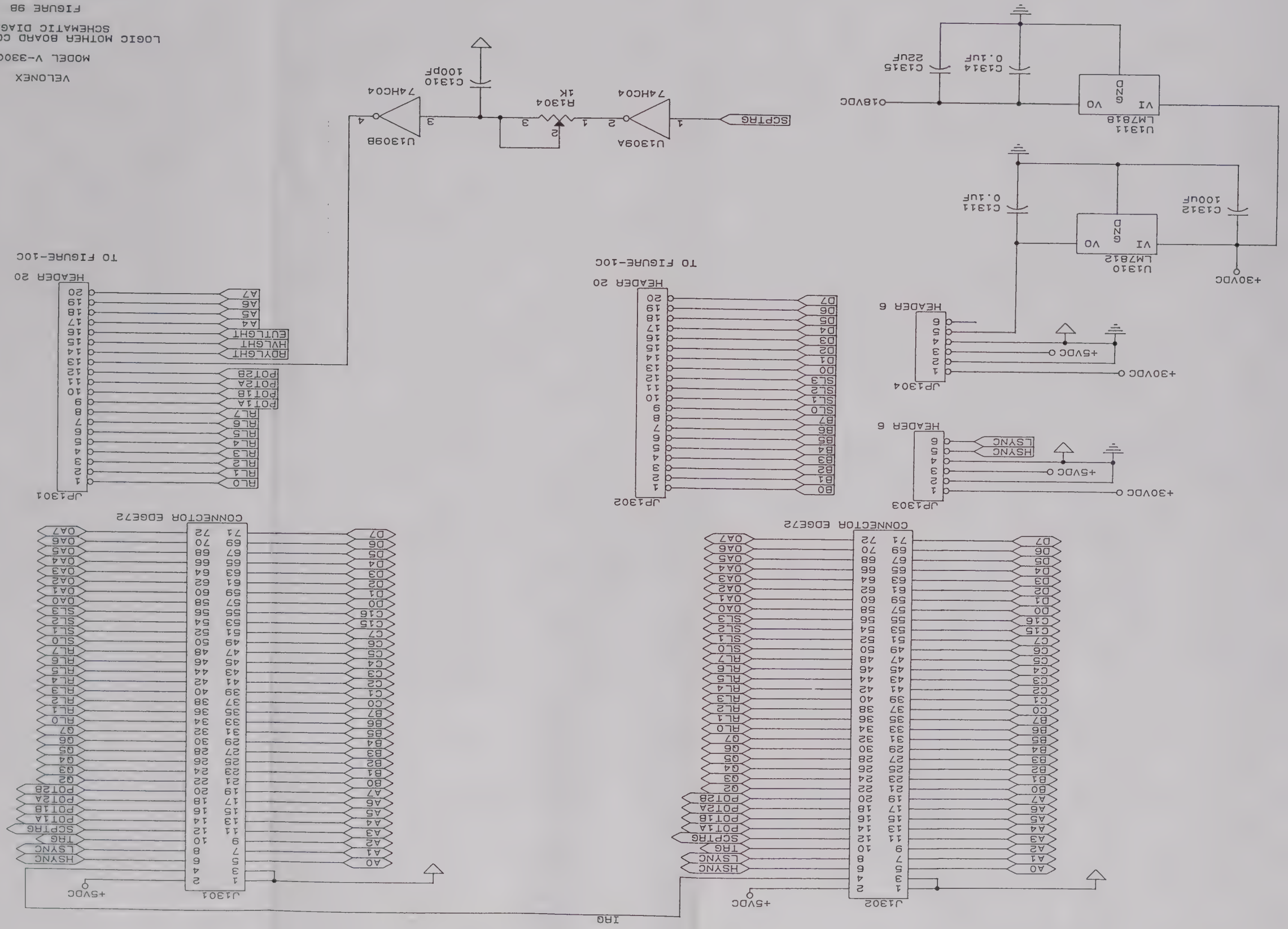
VELONEX

MODEL V-3300

LOGIC MOTHER BOARD CONNECTORS
SCHEMATIC DIAGRAM

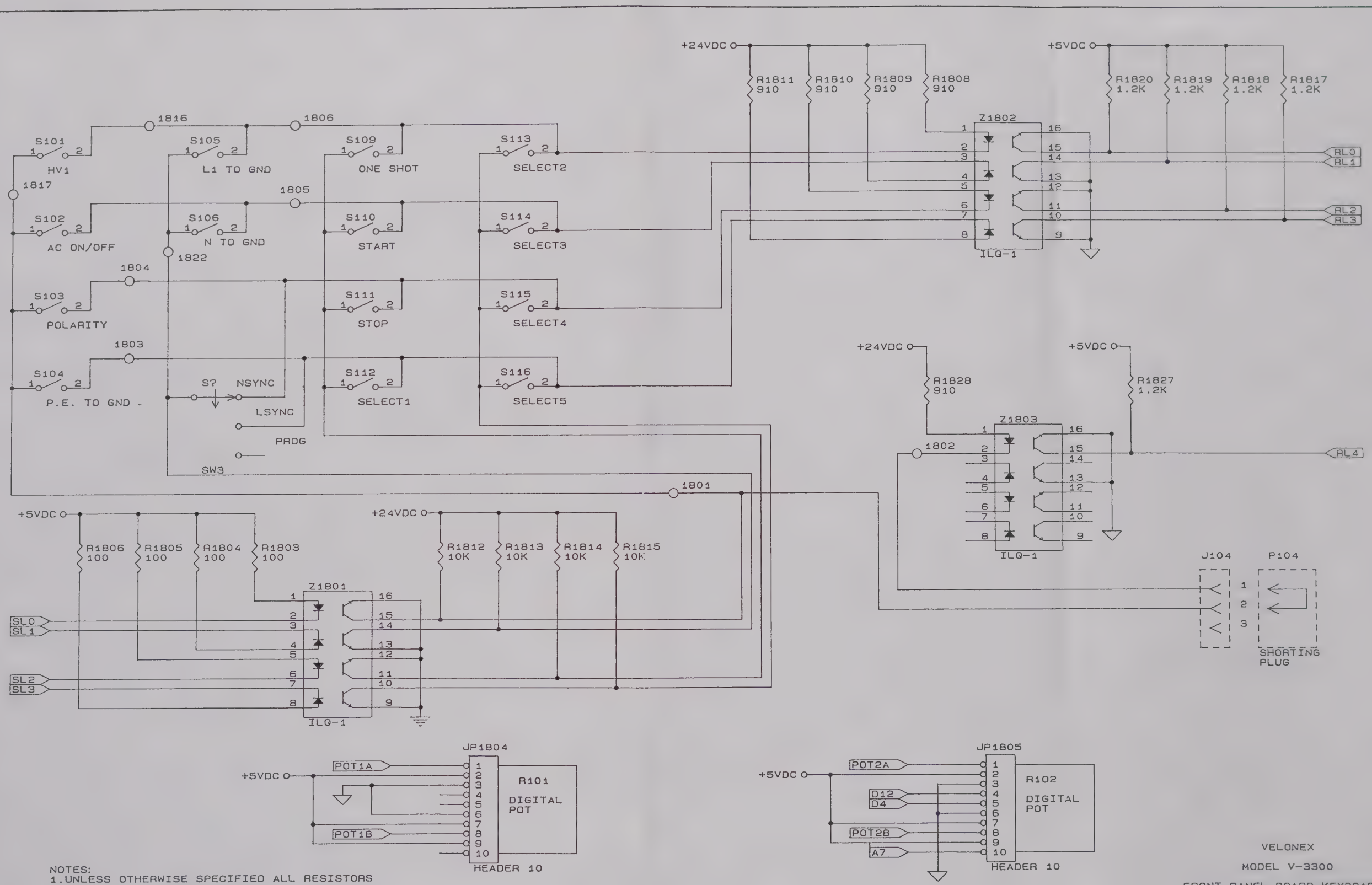
FIGURE 9B

V3300_9B.SCH 2/92



NOTES:
1.UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4W, 5%, IN OHMS.
2.UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE 20% IN MICROFARDS
3.JUMPER IN POSITION "A" FOR V-3300 AND POSITION "B" FOR V-3413.

VELONEX
MODEL V-3300
LOGIC MOTHER BOARD CIRCUIT SCHEMATIC DIAGRAM
FIGURE 9A
3300_9A.SCH 7/92



NOTES:
1.UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4W, 5%, IN OHMS.

2.UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE 20% IN MICROFARADS.

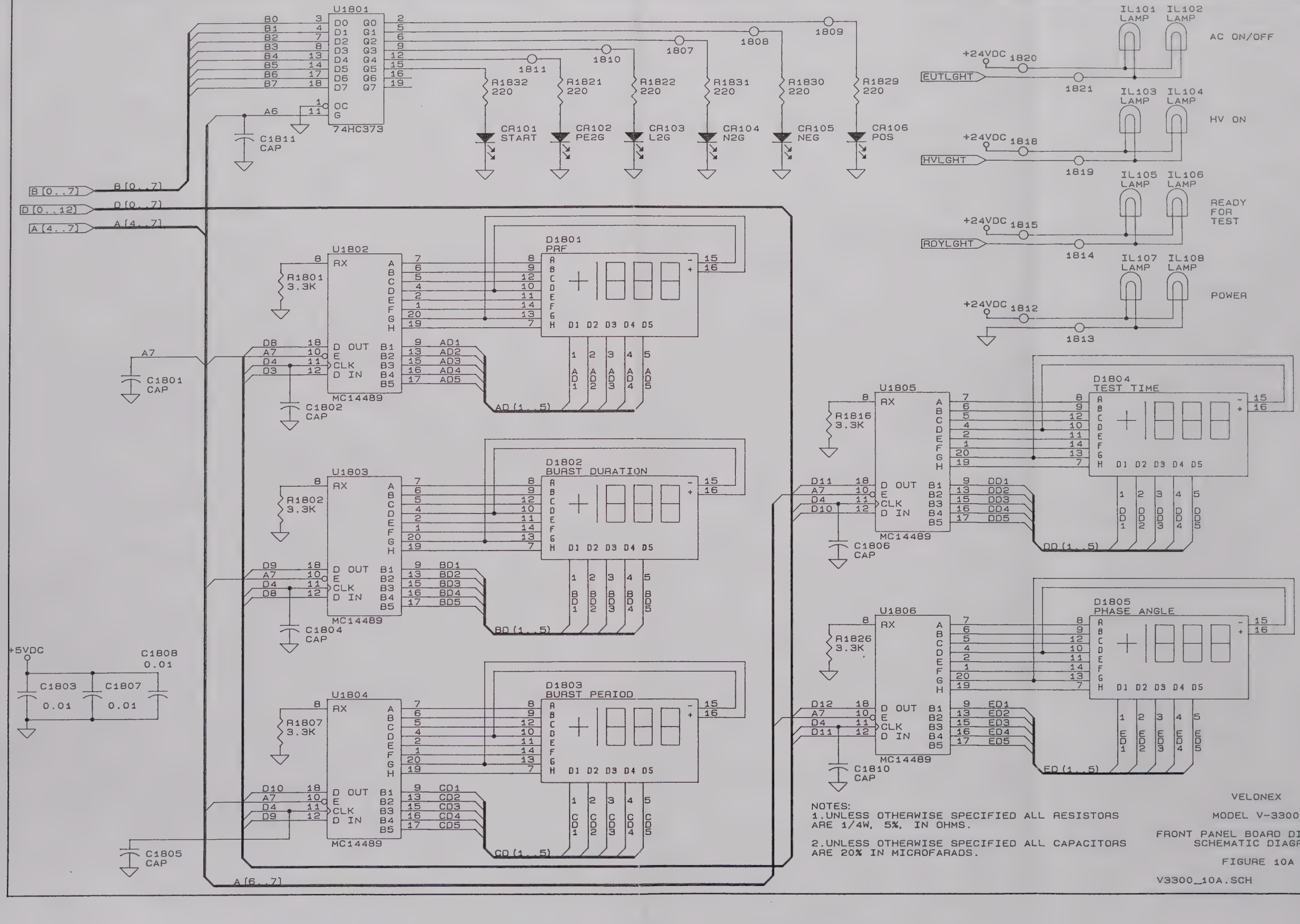
VELONEX

MODEL V-3300

FRONT PANEL BOARD KEYBOARD SCHEMATIC DIAGRAM

FIGURE 10B

V3300_10B.SCH 2/92



NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4W, 5%, IN OHMS.

2. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE 20% IN MICROFARADS.

VELONEX

MODEL V-3300

FRONT PANEL BOARD DISPLAYS SCHEMATIC DIAGRAM

FIGURE 10A

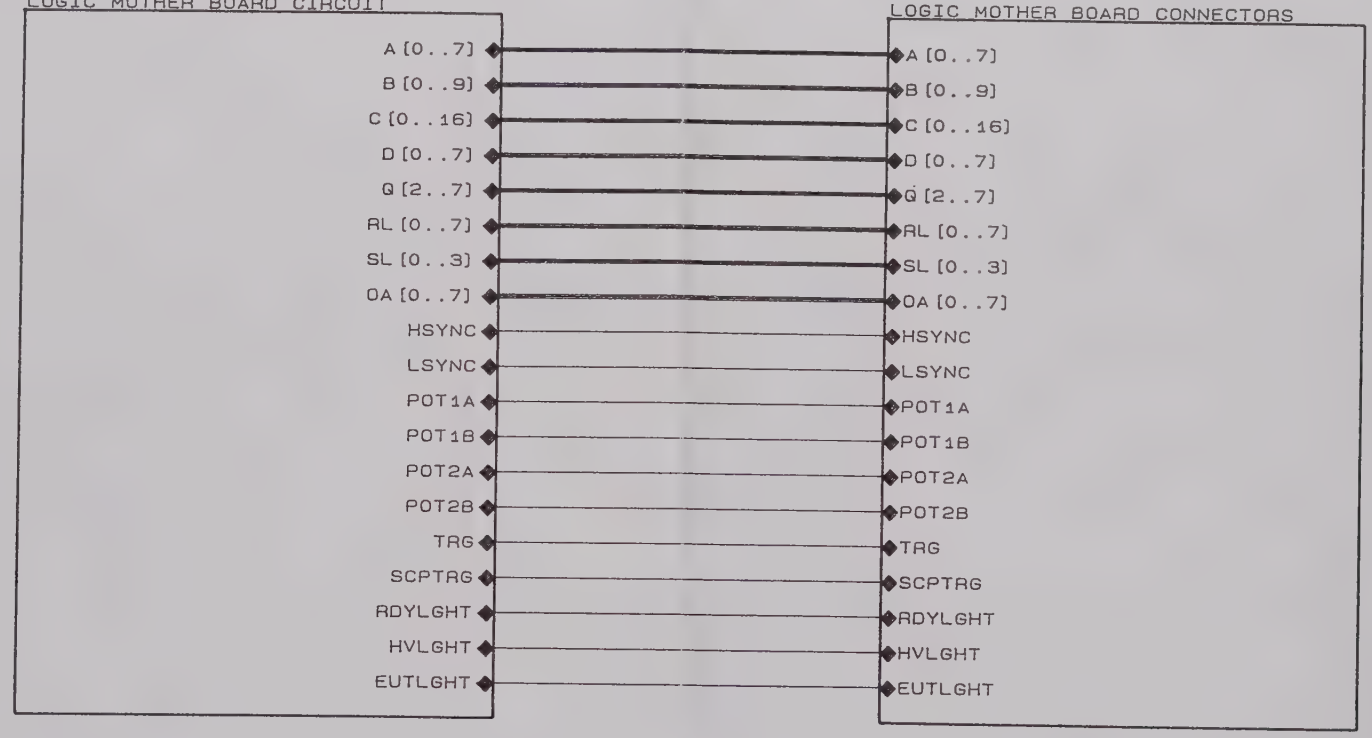
V3300_10A.SCH 2/92

FIGURE-9A

LOGIC MOTHER BOARD CIRCUIT

FIGURE-9B

LOGIC MOTHER BOARD CONNECTORS



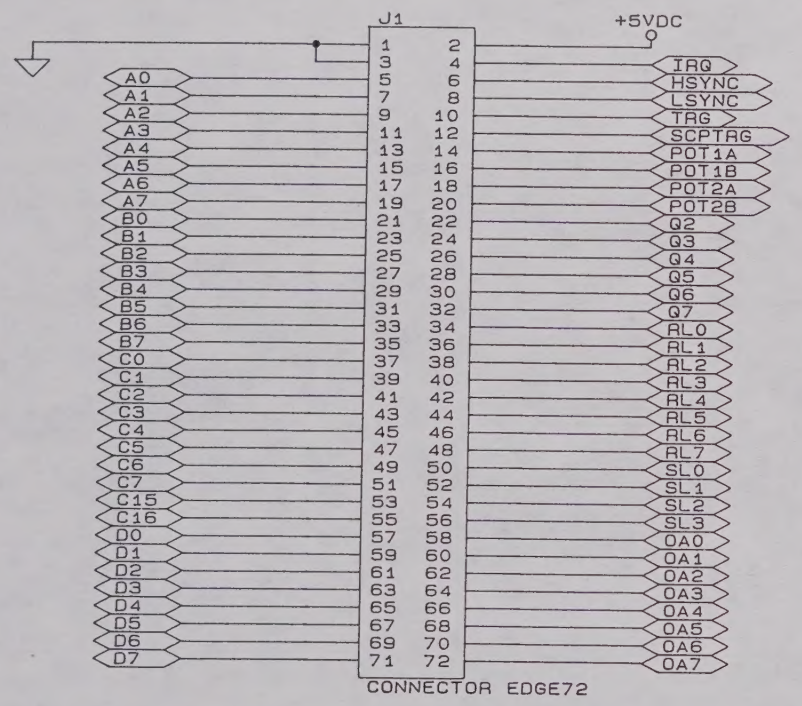
VELONEX

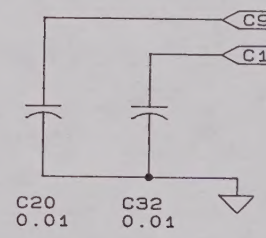
MODEL V-3300

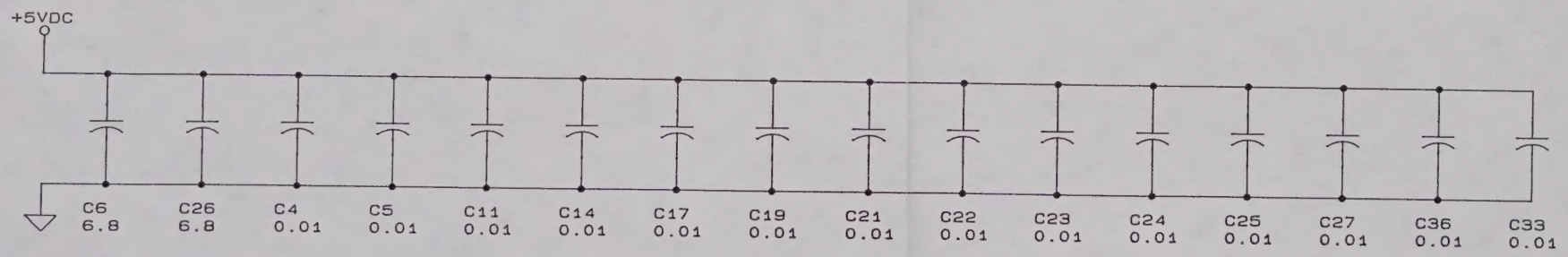
LOGIC MOTHER BOARD
SCHEMATIC DIAGRAM

FIGURE 9

V3300_9.SCH 2/92







NOTE:
1.ALL CIRCUIT DESIGNATIONS ARE 1400 SERIES.

2.UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4W, 5% IN OHMS.

3.UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE 20% IN MICROFARADS.

VELONEX

MODEL V-3300

CONTROL CARD CONNECTOR SCHEMATIC DIAGRAM

V3300_8B.SCH 2/92

NOTES:
1. ALL CIRCUIT DESIGNATIONS ARE 1400 SERIES

2. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4, 5% IN OHMS.

3. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS.

VELONEX

MODEL V-3300

CONTROLLER CARD CIRCUIT SCHEMATIC DIAGRAM

3300_8A.SCH 2/92